Agenda

- What is GRID?
- Examples of GRID performance
- GRID virtualization architectures
- GRID scaling numbers
- Live Demo
VDI
POWERED BY NVIDIA GRID™

VIRTUAL MACHINE

Windows 7

Apps

NVIDIA GRID Enabled
Virtual Desktop Agent

NVIDIA Driver

NVIDIA GRID ENABLED
Hypervisor

NVIDIA GRID GPU

VIRTUAL DESKTOPS
Seimens Teamcenter PLM – 3D Viewer
Citrix XenDesktop with CPU emulated graphics

Citrix XenDesktop with NVIDIA GRID

Virtual desktops with full PTC Creo 2.0 features and performance
The PC

OS

App

App

App

Hardware

Software

CPU

Memory

Storage

Network

GPU

HW Driver

HW Driver

HW Driver

HW Driver

NVIDIA Driver
The PC

**Hardware**
- CPU
- Memory
- Storage
- Network
- GPU

**Software**
- OS
  - Win 7
  - Win 8
  - Linux

**Application**
- NVIDIA Driver
- HW Driver
Why Virtualized Desktops & Applications?

- **Purpose/Goal**
  - Replace physical desktops / laptops with virtual desktops on servers

- **Stakeholders**
  - IT department
  - User

- **Benefits**
  - **Security** - IP stays in the data-center
  - **Manageability** - device proliferation, OS image management & disaster recovery
  - **Resource Utilization** - keep shared resources busy for better ROI
  - **Data Centralization** - keep compute & storage resources closer in the data-center
  - **User Flexibility/Productivity** - any device, anywhere, anytime
Virtualized Desktops
The Virtualized Desktop

software

Virtualization

Hardware

Client

CPU

Memory

Storage

Network

VDA

vCPU

vMemory

vStorage

vNetwork

os

app

os

app

os

app

Guest OS

Virtual Driver

Virtual Driver

Virtual Driver

Virtual Driver

VIRTUAL MACHINE

HYPERVERSOR

Server
GPUs in a Virtual Desktop

- **GPU pass-through**: 1:1 dedicated GPU to user
- **Shared GPU**: *Software* virtualization of the GPU
- **Virtual GPU**: *Hardware* virtualization of the GPU through the NVIDIA GRID software
GPU Pass-Through

- Guest OS
- Server
- CPU
- GPU Pass
- Through
- Hardware
- Memory
- Storage
- Network
- Software
- Virtual
- Driver
- Virtual
- Driver
- Virtual
- Driver
- Virtual
- Driver
- NVIDIA Driver

VIRTUAL MACHINE
- vCPU
- vMemory
- vStorage
- vNetwork
- GPU

HYPervisor

- CPU
- Memory
- Storage
- Network
- GPU

Client

NVIDIA Driver

App

VDA
GPU Pass-Through

**Accelerated Remoting**
- Citrix XenDesktop 5.6 FP1
- Citrix XenDesktop 7
- VMware View 5.x (coming soon)

**NVIDIA Pass-through**
- Citrix XenServer
- VMware ESXi

**GPU**
- GRID K1
- GRID K2
- Quadro 2000-6000
- Quadro K2000-K5000
Software Virtualization

Also known as
- API intercept
- SHIM driver
Software Virtualization

- Hypervisor
  - Guest OS
    - VDA
    - Virtual Driver
    - Virtual Driver
    - Virtual Driver
    - Virtual Driver
    - Virtual Graphics Driver

- Virtual Machine
  - vCPU
  - vMemory
  - vStorage
  - vNetwork
  - vGraphics

- RemoteFX
  - Microsoft Server 2008 R2 - DX9
  - Microsoft Server 2012 - DX9, 10, 11

- VMware vSGA - DX9, OGL2.1

- GRID K1, K2
  - Quadro 4000, 5000, 6000
  - Tesla M2070Q

- NVIDIA Driver

- Client

- Hardware
  - CPU
  - Memory
  - Storage
  - Network
  - GPU
NVIDIA GRID vGPU (virtual GPU)

Also known as
- NVIDIA GRID™ VGX technology
- VGX GPU Hypervisor
- vGPU
- Virtual GPU
- Hardware Virtualization
GRID vGPU

HYPERVISOR

Server

CPU
Memory
Storage
Network
GPU

VIRTUAL MACHINE

vCPU
vMemory
vStorage
vNetwork
vGPU

Guest OS

NVIDIA Driver

VDA

Virtual Driver

Client

GPU

NVIDIA Driver

vGPU

Manager

Graphic Commands

State

App
VDA
## GRID vGPU Profiles

<table>
<thead>
<tr>
<th>Card</th>
<th>Physical GPUs</th>
<th>Virtual GPU</th>
<th>Use Case</th>
<th>Frame Buffer (MB)</th>
<th>Virtual Display Heads</th>
<th>Maximum Resolution</th>
<th>Maximum vGPUs</th>
<th>Cost per User</th>
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<tbody>
<tr>
<td>GRID K2</td>
<td>2</td>
<td>GRID K280Q</td>
<td>High-end Designer</td>
<td>4096</td>
<td>4</td>
<td>2560x1600</td>
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<td>GRID K240Q</td>
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<td>2560x1600</td>
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<td>GRID K2</td>
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<td>GRID K200</td>
<td>Power User / Knowledge Wkr</td>
<td>256</td>
<td>2</td>
<td>1920x1200</td>
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<td>$235</td>
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<td>GRID K140Q</td>
<td>Basic Designer</td>
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<td>256</td>
<td>2</td>
<td>1920x1200</td>
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</tbody>
</table>
XenApp on Bare Metal

Windows Server OS

App
App
App
App
App
App
XenApp
XenApp
XenApp
XenApp
XenApp
XenApp
Terminal Session
Terminal Session
Terminal Session
Terminal Session
Terminal Session
Terminal Session

HW Driver
HW Driver
HW Driver
HW Driver
HW Driver
NVIDIA Driver

DX9
DX11
OGL

Citrix XenApp 6.5
DX 9
Citrix XenApp 6.5 OGL add-on
DX 11, OGL 4.3

Windows Server 2008 R2
Windows Server 2012

Server

CPU
Memory
Storage
Network
GPU
XenApp in a Virtual Machine

VIRTUAL MACHINE 1
- vCPU
- vMemory
- vStorage
- vNetwork
- GPU #1

VIRTUAL MACHINE 2
- vCPU
- vMemory
- vStorage
- vNetwork
- GPU #2

HYPervisor

Server

CPU
Memory
Storage
Network
GRID K2

Software
Virtualization
Hardware
VDI and XenApp comparison

Windows Client OS
- NVIDIA Driver

Windows Client OS
- NVIDIA Driver

Windows Client OS
- NVIDIA Driver

Windows Server OS
- User Session
- User Session
- User Session
- NVIDIA Driver

HYPERVERSOR
Scaling Examples

GRID vGPU K240Q Profile Performance

- Catia03
- Ensign04
- Lightwave01
- Maya03
- Proe05
- Swx02
- TCvi02
- SNx01

SPECViewperf 11

Legend:
- 1 VM
- 4 VMs
- 8 VMs
- 12 VMs
- 16 VMs